

# **Taylor Yard Screening-Level Ecological Risk Assessment**

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## **1.0 Introduction**

This report summarizes the results of a screening-level ecological risk assessment (SLERA) of potential contamination of soil and groundwater at Taylor Yard, Los Angeles. The primary purpose of a SLERA is to eliminate contaminants that do not pose a risk and to identify those contaminants that may pose a risk to organisms, but need further evaluation. This SLERA compares maximum concentrations of contaminants measured on the site to protective benchmarks and suggests possible risks to aquatic and terrestrial wildlife that might use the habitat under current or future conditions.

This report is organized into six sections. Section 1 includes the introduction. Section 2 presents discussions of resources at risk; selection of contaminants of potential concern (COPCs); the fate, transport, and ecotoxicity of COPCs; identification of exposure pathways; and assessment and measurement endpoints. Section 3.0 presents the results of the screening assessment. Section 4.0 provides conclusions and Section 5.0 presents recommendations for additional studies. A list of references is provided in Section 6.0.

The screening-level evaluation was conducted using only the existing information contained in the following sources:

- Summary soil data table provided by Elizabeth Robbins, Miller Brooks Environmental, Inc. (data document, 2001, based on ERM 2000a); and
- Semi-Annual Groundwater Monitoring Report, No. 16. August 1999 – January 2000, Taylor Yard, Los Angeles, California (ERM 2000b).

Soil data used for this assessment were collected between June 1998 and February 1999; groundwater data were collected between August 1999 and January 2000 (ERM 2000a,b). These data were used to evaluate the risk posed by contaminants for restoration alternatives at the Taylor Yard site. The alternatives range from providing primarily dry upland habitat with a perched pond located above groundwater sources to excavating to the elevation of the Los Angeles River to provide flood storage. Therefore, existing conditions may change such that soil remains with little excavation and flooding potential, soil may be excavated and areas flooded to create ponds or flood storage areas, and/or groundwater sources may be intercepted for flow into surface water ponds and the Los Angeles River. Consequently, this SLERA used both soil and sediment benchmarks for assessing soil contaminants and surface water benchmarks for assessing groundwater contaminants.

## 2.0 Environmental Setting and Identification of Contaminants of Concern

### 2.1 Site Description

Taylor Yard is located adjacent to the Los Angeles River between the San Fernando Valley and coastal plain of the Los Angeles Basin. The yard has been in operation since the early 1890s, principally as a locomotive and refrigeration car maintenance center. The Active Yard, located near the river, is generally flat and covered with an average of 6 inches of asphalt, concrete, or ballast.

Contaminants may present ecological risk to biological communities given their presence in soils and groundwater. Contaminants may reach the Los Angeles River or proposed wetlands near the river, in local soils, via surface water runoff, and groundwater discharge. The existing soils at the site could become sediment within restored wetland habitat, providing a pathway for exposure of aquatic resources to possible contaminants currently in soil.

### 2.2 Biological Communities

The Active Yard supports few biological communities at this time. Surrounding areas may support a variety of birds, small mammals, reptiles, amphibians, and terrestrial insects.

Aquatic communities of the Los Angeles River adjacent to Taylor Yard include benthic invertebrates, crayfish, fish, waterbirds, and small mammals. The alternatives proposed for Taylor Yard are primarily focused on providing habitat for birds; however, benthic invertebrates, fish, mammals, reptiles, and amphibians would also be found on the restored site. Habitat restoration could provide a mixture of open water, emergent marsh, riverbank, and upland fringe.

Over 35 bird species have been observed along this reach of the Los Angeles River (Cooper 2000). These species are included in a general list of birds that may be found in the area; Table 2-1 indicates the prey items that constitute their diet (USEPA 1993).

**Table 2-1. Common birds found in the vicinity of Taylor Yard and their diet items.**

Bird	Aquatic Insects	Terrestrial Insects	Plants/ Seeds	Fish	Amphibians/ Reptiles	Birds	Mammals
Herons, egrets	X			X	X	X	X
Surface-feeding ducks	X	X	X				
Bay ducks	X		X				
Osprey				X	X	X	
Hawks		X				X	X
Kestrel/falcons		X			X	X	X
Gulls	X	X		X		X	X
Kingfishers				X			
Wrens	X	X					
American robin		X	X				

Source: USEPA 1993.

### 2.3 Contaminants of Potential Concern

Contaminants of potential concern (COPCs) were identified by comparing the maximum concentration measured in soil and groundwater at the site to available screening benchmarks, criteria, or guidelines. In this SLERA, if the concentration exceeds the benchmark, the contaminant is reported as a COPC. Further assessment would be warranted to determine the ecological risk posed by the contaminant to specific ecological receptors that inhabit the Taylor Yard site.

The classes of compounds that were considered as COPCs were volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs), and trace elements.

The soil chemistry data were first compared to toxicological benchmarks for soil based on toxicity to plants, earthworms, or microbial processes. The lowest value was chosen for trace elements (Efroymson et al. 1997). Benchmarks for organic compounds found at Taylor Yard were not included in Efroymson et al.; therefore, the urban park/residential benchmarks for assessing toxicity to soil invertebrates and plants, as determined by British Columbia (BC 1997), were used.

Soil data were also compared to freshwater sediment benchmarks to identify COPCs for the screening-level risk assessment using threshold effects levels (TELs) from USEPA Assessment and Remediation of Contaminated Sediments (ARCS) program (USEPA 1996a). These values were derived from freshwater exposures of *Hyaella azteca* using 28-day survival, growth, and reproductive endpoints. TELs were calculated as the geometric mean of the lower 15<sup>th</sup> percentile concentrations of the effects data and the 50<sup>th</sup> percentile of the no-effects data. The TELs were selected as protective COPC screening criteria because they are considered to represent sediment concentrations rarely associated with adverse effects to benthic organisms. This comparison was performed under the assumption that these soils data could represent the concentration in sediments of the restoration site.

Groundwater chemistry data were reviewed to identify COPCs by comparison to aquatic life and surface freshwater criteria. EPA ambient water quality criteria (AWQC) or Final Chronic Value (FCV) for the protection of aquatic organisms were used for this assessment (USEPA 1996a). If an AWQC was not available, then a Tier II secondary chronic value was used (Suter and Tsao 1996). Tier II concentrations were developed so that aquatic benchmarks could be established with fewer data than are required for AWQC values. The trace element concentrations are for total dissolved substance.

Table 2-2 presents COPCs identified in soil and groundwater, the maximum detected concentrations of these contaminants measured at the site during 1998 to 2000, and the screening benchmarks for soil, sediment, and water.

**Table 2-2. Maximum detected soil and groundwater concentrations and corresponding screening benchmarks for contaminants of potential concern.**

Chemical (mg/kg)	Soil Maximum Concentration (mg/kg)	Soil Screening Benchmark <sup>a</sup> (mg/kg)	Sediment Screening Benchmark <sup>b</sup> (TEL) (mg/kg)	Groundwater Maximum Concentration (µg/L)	Surface Water Screening Benchmark <sup>c</sup> (µg/L)
<b>Volatile Organic Compounds</b>					
Benzene	0.0093	80 (BC)	Na	1.9	130 (T)
Carbon Tetrachloride	Nd	5 (BC)	Na	1.5	9.8 (T)
Chlorobenzene	0.00084	2 (BC)	Na	Na	64 (T)
Chloroform	0.00056	5 (BC)	Na	4.1	28 (T)
1,1-Dichloroethane	<b>30</b>	5 (BC)	Na	<b>82</b>	47 (T)
1,2-Dichloroethane	0.001	5 (BC)	Na	0.93	910 (T)
1,1-Dichloroethene	0.13	5 (BC)	Na	<b>56</b>	25 (T)
cis-1,2-Dichloroethene	1.0	5 (BC)	Na	8.9	590 (T)
trans-1,2-Dichloroethene	0.0051	5 (BC)	Na	2.3	590 (T)
Tetrachloroethene	<b>2,100</b>	5 (BC)	Na	<b>540</b>	98 (T)
Toluene	0.41	3 (BC)	Na	1.0	9.8 (T)
1,1,1-Trichloroethane	<b>320</b>	5 (BC)	Na	10	11 (T)
1,1,2-Trichloroethane	0.0018	5 (BC)	Na	0.65	1,200 (T)
Trichloroethene	<b>34</b>	5 (BC)	Na	46	47 (T)
m,p-xylenes	Nd	Na	Na	1.1	1.8 (T)
Total Xylenes	3.4	5 (BC)	Na	Na	13 (T)
<b>Semi-Volatile Organic Compounds/PAHs</b>					
Benzo(a)pyrene	<b>0.4</b>	1 (BC)	0.0319	Na	0.014 (T)
Benzo(b)fluoranthene	<b>1.2</b>	1 (BC)	Na	Na	Na
Benzo(a)anthracene	<b>1.8</b>	1 (BC)	0.0317	Na	0.027 (T)
Fluorene	Na	Na	Na	0.82	3.9 (T)
Naphthalene	<b>190</b>	5 (BC)	Na	Na	12 (T)
Butyl benzyl phthalate	Na	Na	Na	3.4	19 (T)
Benzyl alcohol	Na	Na	Na	<b>44</b>	8.6 (T)
Benzoic acid	Na	Na	Na	<b>45</b>	42 (T)
Bis (2 ethylhexyl) phthalate	Na	Na	Na	<b>140</b>	3.0 (T)
Diethyl phthalate	Na	Na	Na	0.76	210 (T)
1,2-Dichlorobenzene	Na	2 (BC)	Na	2.2	14 (T)

Table 2-2, continued.

Chemical (mg/kg)	Soil Maximum Concentration (mg/kg)	Soil Screening Benchmark <sup>a</sup> (mg/kg)	Sediment Screening Benchmark <sup>b</sup> (TEL) (mg/kg)	Groundwater Maximum Concentration (µg/L)	Surface Water AWQC Screening Benchmark <sup>c</sup> (µg/L)
<b>Trace Elements</b>					
Antimony	<b>132</b>	5.0	Na	Nd	30 (T)
Arsenic	<b>37</b>	10	5.9	4.04	190
Barium	Na	300	Na	<b>254</b>	4.0 (T)
Cadmium	Na	4.0	0.583	<b>5.96</b>	1.0 *
Chromium	<b>460</b>	0.4	36.3	28.6	180 *
Cobalt	Na	20	Na	<b>57.9</b>	23 (T)
Copper	Na	50	28.0	<b>60.7</b>	11 *
Lead	<b>5,400</b>	50	35.0	<b>9.72</b>	2.5 *
Molybdenum	Na	200	Na	37.3	370 (T)
Nickel	<b>580</b>	30	18.0	100	160 *
Selenium	Na	1	Na	<b>21.5</b>	5.0
Vanadium	Na	2.0	Na	10.8	20 (T)
Zinc	Na	50	Na	81.9	100 *

<sup>a</sup> Soil benchmarks for trace elements: Efroymson et al. 1997; organic compounds: BC 1997 (BC).

<sup>b</sup> Sediment benchmarks: USEPA 1996a.

<sup>c</sup> Water benchmarks: USEPA 1996b or Suter and Tsao 1996 (T).

\* Hardness-dependent variable; value presented is for hardness of 100 mg/L CaCO<sub>3</sub>. No data were available for hardness in groundwater samples.

Na = not available; Nd = not detected.

**Bold** indicates a concentration that exceeds its respective benchmark.

Table 2-3 lists only those compounds that exceed published criteria or benchmarks. These compounds are considered COPCs for the media where exceedances occurred.

**Table 2-3. Contaminants of potential concern (COPCs).**

Chemical (mg/kg)	Soil	Soil as Sediment	Groundwater as Surface Water
<b>Volatile Organic Compounds (VOCs)</b>			
1,1-Dichloroethane	X		X
1,2-Dichloroethene			X
Tetrachloroethene	X		X
1,1,1-Trichloroethane	X		
Trichloroethene	X		
<b>Semi-Volatile Organic Compounds/PAHs</b>			
Benzo(a)pyrene		X	
Benzo(b)fluoranthene	X		
Benzo(a)anthracene	X	X	
Naphthalene	X		
Benzyl alcohol			X
Benzoic acid			X
Bis (2 ethylhexyl) phthalate			X
<b>Trace Elements</b>			
Antimony	X		
Arsenic	X	X	
Barium			X
Cadmium			X
Chromium	X	X	
Cobalt			X
Copper			X
Lead	X	X	X
Nickel	X	X	
Selenium			X

Many of the VOCs lack criteria. For soils, screening benchmarks are available for a subset of VOCs using British Columbia standards. No TELs have been published for VOCs; therefore, sediment was not screened for these compounds. For groundwater data, USEPA has published VOC screening benchmarks for surface water and aquatic life. Several compounds exceeded soil and groundwater standards; therefore, VOCs are retained as COPCs for the risk assessment at Taylor Yard.

A few semi-volatile organic compounds exceeded soil, sediment, and surface water benchmarks. Trace elements also exceeded soil, sediment, and surface water benchmarks. Therefore, SVOCs and trace elements are retained as COPCs for the Taylor Yard site.

## 2.4 Contaminant Fate and Transport

The fate and transport of contaminants at Taylor Yard will depend on a wide range of characteristics of the surface soils at the site and in the discharge of groundwater to surface waters, as well as on the physical and chemical properties of the individual contaminants. In the following discussion, the fate and transport of VOCs, SVOCs, and trace elements are presented.

#### 2.4.1 Volatile Organic Compounds

Organic compounds that evaporate easily are known as volatile organic compounds (VOCs). Bioaccumulation is usually low and uptake by wildlife relies on intake of contaminated soil or water. Concentrations of VOCs in soil will generally decline in the direction of the sediment-water interface when flooded. In general, VOCs have not been considered primary toxic contaminants in sediments. Wetlands typically have a large diversity of microorganisms and redox conditions that could enhance biodegradation of VOCs; therefore, wetlands are ideal environments for natural attenuation of volatile organic compounds (Lorah et al. 1997).

#### 2.4.2 Semi-Volatile Organic Compounds

SVOCs are a class of organic compounds that do not volatilize as readily as VOCs. Generally, polycyclic aromatic hydrocarbons (PAHs) are the most frequently encountered and toxic class of SVOCs.

PAHs are a class of nonpolar organic compounds characterized by highly aromatic, fused-ring structures. Environmental sources of PAHs include petroleum products and combustion residue (e.g., soot particles). Because of their low aqueous solubilities (0.0003 to 34 mg/L) and high octanol-water partition coefficients ( $\log K_{ow} = 3.4$  to 7.6), PAHs in aquatic systems tend to be associated with dissolved and particulate organic matter.

At Taylor Yard, the fate and transport of PAHs will be largely controlled by total organic carbon content and dissolved organic carbon concentrations in ground and surface waters. The extent to which an individual PAH compound will tend to be associated with either sediment or dissolved organic carbon depends on the relative hydrophobicity of the compound, which can be predicted from its molecular weight. Low-molecular-weight PAHs (LPAHs), with three aromatic rings or less, are more water soluble and more easily degraded. High-molecular-weight PAHs (HPAHs) will tend to predominate in sediments where they are subjected to burial, resuspension, and degradation reactions. The available literature suggests that HPAHs are degraded by microbes slower than LPAHs. Half-lives for these compounds range from months to years. Furthermore, biodegradation probably occurs more slowly in aquatic systems than in soil (Clement Associates 1985).

Uptake of available PAHs by aquatic biota is rapid. However, PAHs are also quickly metabolized and eliminated from most fish, mammals, and birds. Some PAH metabolites have been shown to be toxic. Invertebrates do not metabolize PAHs as efficiently and may accumulate high tissue concentrations (Eisler 1987; Varanasi et al. 1989). Bioconcentration factors for those species that do not metabolize PAHs tend to increase as the molecular weights and the octanol-water partition coefficients of the PAHs increase.



### 2.4.3 Trace Elements

The fate and transport of trace elements in surface soils are governed by the physical and chemical properties of both the trace elements and soil. The fate of trace elements in soil depends on such factors as pH, soil type, particle size, organic matter content of soil, the presence of inorganic colloids and iron oxides, cation exchange capacity, and the amount of other trace elements already in the soil (ATSDR 1998). Some trace elements, such as lead and mercury, can exist in organic forms and bind to organic carbon contained with the soil and sediment. Water and wind erosion can function as effective transport processes for trace elements. Although trace elements may change valence states or shift between organic and inorganic forms, depending on environmental conditions, they do not degrade and are environmentally persistent.

Key factors that affect the speciation, and thus the solubility and bioavailability, of sediment-associated trace elements include Eh (redox conditions), pH, water hardness, and organic carbon content of the water and sediment. The redox conditions, pH, and concentration of dissolved organic carbon in porewater influence the oxidation state and dissolved concentration of the trace element. Trace elements exhibit a range of binding affinities, with both organic and inorganic phases present in the sediment, resulting in varying concentrations of dissolved versus particulate metals. In addition, trace elements exhibit a range of stability constants with dissolved counter ions and ligands, which determines the ratio of precipitated and complexed to freely dissolved species in solution.

Total concentrations of trace elements in sediment are generally not predictive of their bioavailability. Concentrations of certain metals in porewaters have been correlated with biological effects (Di Toro et al. 1990). For several divalent metals, a key partitioning phase controlling cationic metal activity and toxicity in sediments appears to be acid-volatile sulfide (AVS) (Di Toro et al. 1990, 1992; Carlson et al. 1991; Allen et al. 1993; Ankley et al. 1993). Simultaneously extracted metals (SEM) and AVS measurements can be made to assess the potential bioavailability of SEM (cadmium, copper, lead, nickel, and zinc).

## 2.5 Ecotoxicity of Chemicals of Concern

### 2.5.1 VOCs

Some individual VOCs are believed to be a threat to human health. Little information is available as to the toxicity of VOCs to aquatic and terrestrial organisms, but the limited data available indicate that the VOC COPCs are not particularly toxic to aquatic organisms. Because the primary threat to mammals appears to be from cancer, it is only long-lived organisms that may be at risk.

### 2.5.2 SVOCs (PAHs)

Individual PAHs vary substantially in toxicity, depending, in large part, on their molecular weight. Low molecular weight PAHs (2- and 3-ring compounds), such as

naphthalene, fluorene, phenanthrene, and anthracene, are acutely toxic to aquatic organisms. Acute toxicity increases with increasing alkyl substitution on the lower molecular weight compounds (Van Luik 1984). Many of the higher molecular weight PAHs, compounds with 4 to 7 aromatic rings, such as chrysene and benzo(a)pyrene, are less toxic but demonstrably carcinogenic, mutagenic, or teratogenic to a wide variety of organisms including fish, amphibians, birds, and mammals (Moore and Ramamoorthy 1984; Eisler 1987).

*Benthic Invertebrates* – Effects of PAHs observed in benthic invertebrates include inhibited reproduction, delayed emergence, sediment avoidance, and mortality (Eisler 1987, Landrum et al. 1991). In a study of PAH toxicity to the amphipod *Diporeia*, the mechanism identified as most likely responsible for observed acute toxic responses to PAHs was narcosis (Landrum et al. 1991). Generally, aquatic invertebrates are less able to metabolize PAHs than aquatic vertebrates, although metabolization rates vary widely within and between phyla (Meador et al. 1995).

*Fish* – PAHs are generally hydrophobic compounds and must be metabolized to more water-soluble forms before they are excreted (Eisler 1987). In most fish, PAHs are rapidly taken up, metabolized, and excreted so that concentrations found in edible tissues are generally low. Fish do not appear to contain grossly elevated PAH residues; this may be related to their efficient degradation system.

*Birds* - At present, data are lacking or unavailable on PAH background concentrations in natural populations of birds and other wildlife, although it seems unlikely that significant accumulations will occur (Eisler 1987). PAHs are components of petroleum products and the toxicity of petroleum products in birds has been studied. However, toxicity studies that expose birds to petroleum products cannot be used without a direct measure of the PAH concentration associated with the exposure. In one study, Patton and Dieter (1980) fed mallards diets that contained 4,000 mg PAH/kg for a period of 7 months. No mortality or visible signs of toxicity were evident during the exposure; however, liver weights increased 25 percent and blood flow to the liver increased 30 percent when compared to controls (Eisler 1985).

### 2.5.3 Trace Elements

The combination of trace elements in the environment may result in additive, synergistic, or antagonistic effects, with the overall effect depending on the toxicity of the elements present, the specific physical and chemical conditions of the site, and internal synergistic or antagonistic effects within organisms. In fresh water, increasing water hardness decreases the toxicity of cadmium, chromium, copper, lead, nickel, silver, and zinc. The form of the metal also affects toxicity; for example, methylmercury is more toxic than inorganic mercury.

*Benthic Invertebrates* – Toxicity of trace elements to benthic organisms ranges widely, from slight reduction in growth rates to mortality. Mollusks are generally less sensitive

than other aquatic phyla (Leland and Kuwabara 1985). The most sensitive life stages of benthic organisms are generally the embryonic and larval stages.

*Fish* – Fish are exposed to trace elements both in the water column and through the consumption of contaminated prey organisms. Freshwater fish are generally more sensitive to the effects of trace elements than are marine species, and the larval stages are generally most sensitive. Commonly observed effects include reduced growth, survival, and fecundity.

*Birds* – Avian dietary toxicity studies have been conducted with a wide range of trace elements. The observed acute toxicity of the trace element can depend on the organism's body burden of metallothioneins. Ducks contained the highest levels of metallothioneins of a range of wildlife species surveyed (Brown et al. 1970 as cited in Eisler 1985). Sublethal effects can include reproductive and behavioral modifications.

## 2.6 Exposure Pathways

In this section, potential exposure pathways are evaluated to determine which pathways are complete and important at the site. Identifying exposure pathways prior to a quantitative evaluation allows the assessment to focus on only those contaminants that can reach ecological receptors. An exposure pathway is considered complete if a contaminant can travel from the source to ecological receptors and can be taken up by the receptors via one or more exposure routes. Often many pathways are complete, but of varying importance. It is therefore important to identify the key pathways that reflect maximum exposures within the ecosystem and constitute exposure pathways to ecological receptors sensitive to the contaminant.

### 2.6.1 VOCs

VOCs were measured in soil and groundwater at Taylor Yard. In general, the major exposure pathway for VOCs in terrestrial organisms, including invertebrates, birds, and mammals, is through direct contact with and ingestion of contaminated soils and inhalation of volatile compounds. VOCs are not known to biomagnify through the food web.

### 2.6.2 SVOCs (PAHs)

PAHs were measured in soil and groundwater samples associated with the site. The major exposure pathway for PAHs in terrestrial organisms, including invertebrates, birds, and mammals, is through direct contact with and ingestion of contaminated soils. Benthic invertebrates, fish, amphibians, and aquatic birds may be exposed to PAHs via direct contact with or ingestion of contaminated sediments. Food-chain exposure is not expected to be a major exposure route for PAHs, although insectivorous birds may ingest invertebrates contaminated with PAHs. PAHs do not tend to biomagnify; therefore, piscivorous or predatory birds and mammals would be exposed to a low risk from these compounds.

### 2.6.3 Trace Elements

The major exposure pathway for trace elements to terrestrial invertebrates is through direct contact with and ingestion of soils. Mammals and birds at the site may also be exposed to trace elements through direct contact with and ingestion of soils and surface water at the site and through ingestion of invertebrates coming in contact with contaminated soil. None of the trace elements detected in soils tend to biomagnify through the food web. Benthic invertebrates, fish, amphibians, and aquatic birds at the site may be exposed to trace elements via direct contact with and ingestion of contaminated food, sediments, and surface water.

Groundwater discharge can result in the release of contaminants into aquatic habitats. The maximum concentrations of several trace elements exceeded the corresponding surface water benchmarks (Table 2-2). For this SLERA, the exposure pathway for groundwater was considered for discharges into surface water at the concentration observed in groundwater samples.

## 2.7 Assessment Endpoints

As defined in USEPA (1992), assessment endpoints are expressions of the actual environmental values that are to be protected, such as ecological resources. Assessment endpoints are generally tied to the response of ecological receptor species to environmental stresses. Unless an ecological receptor is listed as a protected or endangered species, assessment endpoints are selected that are relevant to population-level rather than individual effects.

Assessment endpoints for Taylor Yard include:

- Protection of terrestrial birds and mammals from adverse effects on growth, survival, and/or reproduction
- Protection of benthic invertebrates from adverse effects on survival, abundance, growth, and diversity of benthic communities
- Protection of aquatic organisms from adverse effects on growth, survival and reproduction

Measurement endpoints are measurable biological responses to the valued characteristics chosen as assessment endpoints. The measurement endpoints corresponding to the assessment endpoints selected for this SLERA are presented below:

- Compare concentrations of COPCs in soils to screening benchmarks for soils
- Compare concentrations of COPCs in soils to screening benchmarks for freshwater sediments at threshold and potential effects levels

- Compare concentrations of COPCs in groundwater to surface freshwater quality criteria for aquatic life

### 3.0 Screening Level Evaluation

#### 3.1 Methods

Screening for risks posed to terrestrial, benthic, and aquatic organisms from contaminants in soil and groundwater was conducted using the benchmarks discussed in Section 2.3. Hazard quotients (HQs) were then calculated as the ratio of the maximum concentration measured at the site divided by the corresponding benchmark.

#### 3.2 Terrestrial Organisms

The soil concentrations, benchmarks, and the calculated hazard quotients (HQs) are presented in Table 3-1.

**Table 3-1. Maximum soil concentrations, benchmarks, and calculated HQs**

Chemical (mg/kg)	Concentration	Soil Benchmark <sup>a</sup>	HQ <sup>b</sup>
<b>Volatile Organic Compounds (VOCs)</b>			
1,1-Dichloroethane	30	5	6.0
Tetrachloroethene	2,100	5	420
1,1,1-Trichloroethane	320	5	64
Trichloroethene	34	5	6.8
<b>PAHs</b>			
Benzo(b)fluoranthene	1.2	1	1.2
Benzo(a)anthracene	1.8	1	1.8
Naphthalene	190	5	38
<b>Trace Elements</b>			
Antimony	132	5.0	26.4
Arsenic	37	10	3.7
Chromium	460	0.4	1,150
Lead	5,400	50	108
Nickel	580	30	19.3

<sup>a</sup> Soil benchmarks for trace elements: Efroymson et al. 1997; organic compounds: BC 1997.

<sup>b</sup> Hazard quotient = concentration/screening benchmark.

VOCs exhibited HQs ranging from 6 to 420; HQs for PAHs ranged from 1.2 to 38. The HQs for trace elements ranged from 3.7 to 1,150. Substances with the highest HQs included chromium, lead, and tetrachloroethene. These contaminants are not subject to biomagnification in the food chain. However, there is a possibility for contaminants to be ingested by terrestrial invertebrates.

#### 3.3 Benthic Invertebrates

As alternative plans for this site involve flood control or wetland functions, an evaluation for potential contamination of soils when flooded is provided based on a comparison of soil data to sediment benchmarks (Table 3-2). The most conservative benchmark is the Threshold Effect Value (TEL), used for the preliminary screening. Contaminants with concentrations below TEL values are very unlikely to pose a threat to benthic organisms.

Conversely, contaminant concentrations above TELs do not necessarily indicate that toxic effects will result. Upper threshold values, such as the Probable Effect Level (PEL), are more likely to indicate concentrations at which effects would be observed. Table 3-2 includes benchmarks and associated HQs for both TELs and PELs.

**Table 3-2. Soil concentrations compared to sediment benchmark concentrations**

Chemical (mg/kg)	Concentration	Sediment Benchmarks <sup>a</sup>		HQ <sup>b</sup>	
		TEL	PEL	TEL	PEL
PAHs					
Benzo(a)pyrene	0.4	0.0319	0.782	13	0.51
Benzo(a)anthracene	1.8	0.0317	0.385	57	4.7
Trace Elements					
Arsenic	37	5.9	17	6.3	2.2
Chromium	460	36.3	90	13	5.1
Lead	5,400	35	91.3	150	59
Nickel	580	18	35.9	32	16

<sup>a</sup> Sediment screening benchmarks: USEPA 1996a.

<sup>b</sup> Hazard quotient = concentration/screening benchmark.

The highest HQs for TEL and PEL benchmarks were observed for lead, nickel, and benzo(a)anthracene. Results show HQs for PELs above 1 for these chemicals, as well as chromium and arsenic, indicating that a risk may be posed to benthic organisms exposed to these substances.

### 3.4 Aquatic Organisms

Concentrations of contaminants in groundwater may represent a potential source of contamination to surface water, and thereby to aquatic organisms, such as fish. This evaluation compares COPC concentrations in groundwater to aquatic life benchmarks for surface freshwaters (Table 3-3).

**Table 3-3. Concentrations, surface water benchmarks, and hazard quotients (HQs) for contaminants in groundwater**

Chemical (µg/L)	Concentration	Screening Benchmark <sup>a</sup>	HQ <sup>b</sup>
<b>VOCs</b>			
1,1-Dichloroethane	82	47 (T)	1.7
1,1-Dichloroethene	56	25 (T)	2.2
Tetrachloroethene	540	98 (T)	5.5
<b>SVOCs/PAHs</b>			
Benzyl alcohol	44	8.6 (T)	5.1
Benzoic acid	45	42 (T)	1.1
Bis (2 ethylhexyl) phthalate	140	3.0 (T)	47
<b>Trace Elements</b>			
Barium	254	4.0 (T)	64
Cadmium	5.96	1.0 *	6.0
Cobalt	57.9	23 (T)	2.5
Copper	60.7	11 *	5.5
Lead	9.72	2.5 *	3.9
Selenium	21.5	5.0	4.3

<sup>a</sup> Water benchmarks: USEPA 1996b or Suter and Tsao 1996 (T).

<sup>b</sup> Hazard quotient = concentration/screening benchmark.

\* Hardness-dependent value given for 100 mg/L calcium carbonate.

HQs ranged from 1.1 to 64 with barium and bis (2 ethylhexyl) phthalate exhibiting the highest values. These results indicate it is possible that the listed chemicals could pose a risk to aquatic organisms if present in surface water at the concentrations measured in groundwater.

### 3.5 Uncertainties

Given the limited dataset and conservative approach using the maximum concentration of a contaminant, several uncertainties need to be considered for future evaluations. The soil dataset that was evaluated for this screening level risk assessment was limited given summarized data were provided for soil samples collected only between June 1998 and February 1999. It is not known if these are the maximum concentrations of contaminants that have been measured at Taylor Yard, nor what is the extent of elevated concentrations within the site.

Data provided for soil samples did not include information of chemical analyses of polychlorinated biphenyls (PCBs), pesticides, or other organochlorine compounds. Although no record of their use has been mentioned in report summaries, it would be useful to know if analyses for these types of compounds have been conducted at the site. In addition, it does not appear that barium, cadmium, cobalt, copper, molybdenum, selenium, vanadium, and zinc were analyzed in soils, although they were analyzed in groundwater.

Uncertainties as to the total risk to benthic invertebrates exist given that a limited suite of compounds/chemicals was analyzed in soils. It is not known how concentrations of



contaminants will be affected when soils are flooded, nor which soils will remain at the site following excavation.

Groundwater data for two sampling dates between August 1999 and January 2000 were used for this SLERA. It is not known if these values represent the maximum concentrations of contaminants in recent years. The groundwater samples appeared to be unfiltered. The fraction of the measured concentration that represents the dissolved concentration, which is the most bioavailable fraction, is unknown. Also, it is not known how contaminant concentrations will change at the time groundwater reaches the sediment/surface water interface or is diluted by surface waters.

## 4.0 Conclusions

The hazard quotients calculated from the screening-level assessment indicate that exposure to soil may pose a risk to terrestrial organisms. However, the screening results are likely to overestimate the risk to birds, the primary species of concern, because the benchmarks are based on toxicity to soil invertebrates or microorganisms that are in direct contact with the soil. In addition, because these benchmarks were developed for screening purposes, they are very protective values.

The HQs for soil as future sediment, calculated from both TELs and PELs, indicate a probable risk to benthic organisms. Aquatic organisms are also at risk based on HQs for groundwater, assuming that groundwater is not diluted by any other water source when it becomes surface water. The screening-level evaluation for benthic and aquatic organisms also is very conservative given concentrations of contaminants have not been measured in existing sediments or surface waters.

## 5.0 Recommendations

### 5.1 Terrestrial Organisms

Based on this screening-level ecological risk assessment, a further evaluation could consider the potential effects of a contaminant through the ingestion of contaminated prey or other food items by birds and wildlife. Such an evaluation could be conducted using a simple food ingestion model and comparing estimated concentrations of COPCs in the diet to concentrations shown in laboratory studies to be toxic to birds or wildlife. Because VOCs are volatile and do not accumulate in plants or organisms, the ingestion pathway for these compounds is not a concern. The food ingestion model would help to determine if estimated concentrations of PAHs and trace elements in the diet pose a risk to selected bird or mammal species. The model should use mean soil concentrations rather than maximum concentrations because the foraging area of the receptors of concern will most likely include the entire site. The model does not need to consider trophic transfer through the food web because the COPCs are not known to biomagnify.

Additional evaluation of risk should consider that the recommended alternatives involve excavation of soil. It is possible that the most contaminated soil will be removed from the site, but it is also possible that deeper soil that is more contaminated may be exposed. The nature and extent of soil contamination after the creation of new habitats must be taken into consideration.

### 5.2 Benthic and Aquatic Organisms

As noted above, the nature and extent of contamination in aquatic habitats after excavation and creation of new habitat should be determined based on COPC concentrations present in soil located just below the excavation depths. If it is determined that a risk might still be posed to benthic organisms based on predicted

chemical concentrations in sediment, then amphipod toxicity tests might be considered to focus further risk evaluations.

The aquatic organism screening-level evaluation is likely to be an overly protective assumption for restoration alternatives 1, 2, and 4 that would provide a hydraulic connection to the Los Angeles River. A site-specific evaluation could be conducted to determine the contributions from groundwater versus other sources. It is likely that the only COPCs that would remain a concern after dilution are bis (2 ethylhexyl) phthalate and barium, assuming the diluting waters are not contaminated. The extent of contamination by these COPCs should be evaluated to determine if the elevated concentrations were frequent and widespread occurrences. If so, water toxicity tests might be considered to focus the risk assessment for these COPCs. Restoration Alternative 3 would eliminate risk from groundwater contamination because the habitat would be created above groundwater elevations.

## 6.0 References

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